

In the Claims:

Claim 1 (previously presented) A catalyst for oxygen reduction comprising a ruthenium sulfide supported on a conductive support.

Claim 2 (previously presented) The catalyst of claim 1 wherein the conductive support is a conductive carbon having a surface area exceeding 120 g/m².

Claim 3 (previously presented) The catalyst of claim 2 wherein said conductive carbon is a carbon black having a surface area exceeding 120 g/m².

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Claim 5 (previously presented) The catalyst of claim 1 obtained by incipient wetness impregnation of said support with an aqueous solution of precursor salts of ruthenium, optionally comprising ruthenium chloride, drying the impregnated support and treating the resulting product under an atmosphere of hydrogen sulfide optionally diluted with an inert carrier gas.

Claim 6 (previously presented) The catalyst of claim 3 obtained by aqueous precipitation of a ruthenium oxide on said carbon, drying and treating the resulting product under an atmosphere of hydrogen sulfide optionally diluted with an inert carrier gas.

Claim 7 (presently amended) The catalyst of claim 1 wherein said sulfide is a ternary sulfide of ruthenium and a transition metal M.

Claim 8 (previously presented) The catalyst of claim 7 wherein said transition metal M is selected from the group consisting of Co, Ni, Re, Cr, Mo and Ir.

Claim 9 (previously presented) The catalyst of claim 1 wherein said sulfide is a sulfide of cobalt and ruthenium, supported on carbon.

Claim 10 (previously presented) The catalyst of claim 9 wherein the atomic ratio Ru:Co is comprised between 0.2 and 5.

Claim 11 (previously presented) The catalyst of claim 7 obtained by incipient wetness impregnation of said conductive support with an aqueous solution of precursor salts, optionally chlorides, of ruthenium and of transition metal M, drying said impregnated support and treating the resulting product under an atmosphere of hydrogen sulfide optionally diluted with an inert carrier gas.

Claim 12 (previously presented) The catalyst of claim 9 obtained by incipient wetness impregnation of carbon support with an aqueous solution of precursor salts of ruthenium and of cobalt, drying said impregnated carbon and treating the resulting product under an atmosphere of hydrogen sulfide optionally diluted with an inert carrier gas.

Claim 13 (previously presented) The catalyst of claim 12 wherein said precursor salts comprise at least one of RuCl₃ and Co(NO₃)₂.

Claim 14 (previously presented) The catalyst of claim 11 wherein said aqueous solution of precursor salts comprises 2-propanol.

Claim 15 (previously presented) The catalyst of claim 11 wherein said drying step is carried out under vacuum at a temperature above 90°C.

Claim 16 (previously presented) The catalyst of claim 11 wherein said treatment under an atmosphere of hydrogen sulfide is carried out in a flow reactor.

Claim 17 (previously presented) The catalyst of claim 11 wherein said treatment under an atmosphere of hydrogen sulfide is carried out at a temperature exceeding 100°C.

Claim 18 (previously presented) The catalyst of claim 11 wherein said treatment under an atmosphere of hydrogen sulfide is protracted for a time exceeding thirty minutes.

Claim 19 (previously presented) The catalyst of claim 11 wherein said inert carrier gas is nitrogen and the molar ratio of said nitrogen sulfide is comprised between 0.5 and 4.

Claim 20 (previously presented) A gas diffusion electrode comprising a conductive web wherein the catalyst of claim 1 is applied on at least one face of said conductive web.

Claim 21 (previously presented) The gas diffusion electrode of claim 20 wherein said conductive web is a carbon cloth.

Claim 22 (previously presented) The gas diffusion electrode of claim 20 wherein said catalyst is mixed with an optionally perfluorinated hydrophobic binder.

Claim 23 (previously presented) A method for producing a catalyst for oxygen reduction comprising the steps if subjecting a conductive support to incipient wetness impregnation with a solution containing at least one precursor of ruthenium, drying the impregnated support and treating the resulting product under an atmosphere of hydrogen sulfide optionally diluted with an inert carrier gas.

Claim 24 (previously presented) The method of claim 23 wherein said solution also contains a precursor of a transition metal.

Claim 25 (previously presented) The method of claim 24 wherein said transition metal is selected from the group consisting of Co, Ni, Re, Cr, Mo and Ir.

Claim 26 (previously presented) The method of claim 25 wherein said

solution contains at least one RuCl₃ and Co(NO₃)₂.

Claim 27 (previously presented) The method of claim 26 wherein the molar ratio of Ru:Co in said solution is comprised between 0.2 and 5.

Claim 28 (previously presented) The method of claim 23 wherein said solution comprises 2-propanol.

Claim 29 (previously presented) The method of claim 23 wherein said drying is carried out under vacuum at a temperature above 90°C.

Claim 30 (previously presented) A method for producing a catalyst for oxygen reduction comprising the steps of precipitating a ruthenium oxide on a conductive support dispersed in an aqueous solution, drying the impregnated support and treating the resulting product under an atmosphere of hydrogen sulfide optionally diluted with an inert carrier gas.

Claim 31 (previously presented) The method of claim 23 wherein said treatment under an atmosphere of hydrogen sulfide is carried out in a flow reactor.

Claim 32 (previously presented) The method of claim 23 wherein said treatment under an atmosphere of hydrogen sulfide is carried out at a temperature exceeding 100°C.

Claim 33 (previously presented) The method of claim 23 wherein said treatment under an atmosphere of hydrogen sulfide is protracted for a time exceeding thirty minutes.

Claim 34 (previously presented) The method of claim 23 wherein said inert carrier gas is nitrogen and the molar ratio of said nitrogen to said hydrogen sulfide is between 0.5 and 4.

Claim 35 (previously presented) The method of claim 30 wherein said ruthenium oxide is RuO₂ precipitated by reacting an aqueous solution containing a ruthenium compound, optionally RuCl₃, with sodium acid carbonate, or by reacting ruthenium sulfite acid with hydrogen peroxide.

Claim 36 (previously presented) A method for producing a gas diffusion electrode of claim 20 comprising coating said conductive web on at least one side thereof with said catalyst optionally mixed with a first hydrophobic binder.

Claim 37 (previously presented) The method of claim 36 wherein said conductive web is a carbon cloth.

Claim 38 (previously presented) The method of claim 36 wherein said first hydrophobic binder is perfluorinated.

Claim 39 (previously presented) The method of claim 36 wherein said conductive web is coated with a mixture if carbon powder and a second optionally perfluorinated hydrophobic binder on at least one side thereof, prior to said coating with said catalyst.

Claim 40 (previously presented) The method of claim 36 further comprising a final sintering step.

Claim 41 (previously presented) The method of claim 40 wherein said final sintering step comprises heating under a hydrogen atmosphere from room temperature up to an intermediate temperature, and subsequently heating under an inert atmosphere from said intermediate temperature up to a final temperature.

Claim 42 (previously presented) The method of claim 41 wherein said intermediate temperature is between 100 and 120°C.

Claim 43 (previously presented) The method of claim 41 wherein said final temperature is between 300 and 350°C.

Claim 44 (previously presented) The method of claim 41 wherein said inert atmosphere is an argon atmosphere.

Claim 45 (previously presented) A process of hydrochloric acid electrolysis

cell, comprising assembling the gas diffusion cathode of claim 20 as the cathode of electrolysis cell fed in an aqueous solution hydrochloric acid and supplying oxygen thereto while applying electrical current.

Claim 46 (previously presented) The catalyst of claim 10 wherein the atomic ratio is 2.8 to 3.2.

Claim 47 (previously presented) The catalyst of claim 17 wherein the temperature is between 300 and 500°C.

Claim 48 (previously presented) The catalyst of claim 18 wherein the time is 1 to 4 hours.